ONE THOUSAND ABDOMINAL CLOSURES BY A NEW METHOD, WITHOUT A KNOWN HERNIA.[1]

BY JAMES FAIRCHILD BALDWIN, M.D.,
OF COLUMBUS, OHIO,
Surgeon to Grant Hospital.

A HALF-DOZEN or less ventral hernias out of a hundred abdominal sections will give a surgeon far more annoyance, embarrassment, and worry than an equal number of fatal results. In regard to his fatal cases he may justly feel that all was done that human power could do, and that the result was inevitable; but with his hernias he cannot but feel that with greater care, or by a different procedure, the unfortunate result might have been obviated; and the unhappy patients and their friends are very apt to take the same unfavorable view of it.

According to the statistics carefully collected by Dr. W. D. Haggard, of Nashville, in an excellent article on the methods of closing abdominal incisions in *American Medicine*, of February 7, 1903, it is probably fair to assume that about 10 per cent. of abdominal sections closed by prevailing methods result in subsequent hernias. If the incision becomes infected, then at least 50 per cent. of hernias will follow. It would seem as though methods should be devised which would greatly reduce this percentage.

In a personal experience covering over 2000 celiotomies, I have used all the methods that have ever been seriously suggested, but have finally adopted a method which, in something over 1000 cases, has failed to show a single known hernia.

The through-and-through suture is recognized by all as giving unsatisfactory results, and it makes no difference whether silk, silkworm gut, or wire is used as the suture ma-

[1] Read before the Ohio State Medical Society, June 4, 1903.

terial. That method entirely fails to secure anything like coaptation of the fascia, unless it be by the merest chance, and a weak abdominal wall is almost a necessary consequence.

Buried silver wire, while securing accurate coaptation and ideal immediate results, is entirely unsatisfactory in the end. That the silver wire is sterile, or easily made so, is of course true; but the statement sent forth from Johns Hopkins, that the silver salts resulting from the contact of the tissues with the wire are slightly antiseptic, cannot be believed by those who have had any extended experience in the use of this material. It has happened scores of times in my work with silver wire that, six months to a year after apparently perfect union, the wire has become the source of suppuration, with the formation of an abscess which only healed after the wire was fished out. My experience with silver wire was absolutely and unequivocally disgusting, and I was not surprised when told by one of the leading surgeons of the Johns Hopkins Hospital, at the Philadelphia meeting of the American Medical Association, that that material was no longer so used at that institution. I have seen no published statement, however, to that effect.

Silkworm gut as a buried suture has all the disadvantages of silver wire, besides some peculiar to itself. Its ends cannot be bent down flat, and its surface may become quite rough. It is as unabsorbable as wire. A number of years ago I reopened an abdomen some five years after the appendages had been removed by a surgeon in Southern Ohio. For some reason he had used silkworm gut in closing the tops of the broad ligaments. There had been no infection, but there had been constant discomfort in the pelvis during the intervening years, and at the operation the broad ligaments, bristling with a dozen silkworm-gut sutures—as stiff and hard as when they were first inserted—appeared like a section of barbed-wire fence running across the pelvis. The use of buried silkworm gut, while advocated by a few surgeons not many years ago, has been, I think, abandoned by all. I used it in but a single case, and had to remove all those stitches subsequently.

Catgut, chromicized so as to last from two to four weeks, if it could be made assuredly sterile and be so kept until absorbed, would be absolutely the ideal material for closing the abdomen.

Catgut can unquestionably be rendered absolutely sterile, but in its introduction it is liable to become infected by the fingers of the operator, or by the instruments, sponges, or what not, in the field of operation. The surgeon's fingers, as the thread slips through them, are probably the greatest source of danger, but the other sources cannot be obviated entirely. If the gut once becomes infected, the infection will almost certainly extend from end to end of the wound, with resulting disaster. If the catgut is used only to bring the fascia together, and the rest of the wound is closed with through-and-through silkworm gut, then the occurrence of a single stitch abscess may infect the catgut, and again disaster will follow. (If catgut or kangaroo tendon is used, then rubber gloves should be worn by the operator when closing the incision, and every care taken to avoid any possible infection of the suture material. During the operation itself, I think rubber gloves objectionable, since, after a somewhat extended experience, I have found them to obtund too much the delicacy of touch which the operator so greatly needs; but this objection does not hold when it comes to closing the incision.)

One serious objection to the closing of the wound in layers is the formation of dead spaces between each layer. Usually no harm whatever results from these spaces, but sometimes an excellent culture medium collects and the slightest infection makes trouble.

A method by which the advantages of the tier suture can be obtained, but without dead spaces and without leaving behind any suture material after it has served its purpose, would seem to meet every requirement.

Of course, in cases in which the patient's condition is desperate, the through-and-through suture, being the most speedy, will uniformly be resorted to; and in cases in which drainage must be provided for, other than ideal methods of closure may

be necessary; but when the incision is of the ordinary character, when no drainage is necessary, and the abdominal walls present no obstacle, then the method suggested should certainly be employed.

Since June 19, 1897, I have used a method of closing the incision which seems to me to meet all the indications, and which in my hands has, so far as I can learn, in something over a thousand cases given perfect results.* At first I used silver wire, but I soon found that this did not possess the tensile strength to be satisfactorily used in that way, since it would occasionally break during its withdrawal. I therefore sought for some other material, and finally selected annealed iron wire, tinned. (This wire comes in various sizes, but I use No. 26. It can be obtained at the hardware stores, and costs twenty-five cents per box of one dozen spools. I have found this wire equally superior also in wiring bones.) It is strong, flexible, and tough, and is of course sterilized by boiling with the instruments.

In closing an ordinary abdominal incision made in the median line:

1. The bellies of both recti muscles are exposed so that they will be brought into direct apposition when the sutures are tightened. While muscular tissue in itself has little power to prevent a hernia, it nevertheless serves as an excellent buffer, and keeps the abdominal contents from direct impact against the line of closure of the fascia.

2. Through-and-through silkworm gut is then introduced, *from within out;* the needle being so introduced as to catch merely the edge of the peritoneum, and then passed well back through the muscle and fascia and out at a suitable distance from the skin margin.

3. The fascia is next brought together by an over-and-over stitch, using a doubled thread of either coarse silk or cotton. This is introduced into the needle so as to give a loop

* This method was first described by me in a little monograph on "Operative Gynæcology," issued in 1898.

about two feet long. To the end of this loop is attached the wire, which is sharply bent upon itself, so as to be readily drawn through the tissues, the loop being used merely as a guide for the easier introduction of the wire. The over-and-over stitch is so passed as to take in about a quarter of an inch of the edge of the fascia, and includes no other tissue. It is introduced very loosely, so that each turn can be caught later with the finger. As it reaches the end of the incision, it is passed from within out through fat and skin so as to make its exit an inch or more above the end of the incision. By means of this guide thread, the wire is introduced loosely so that it lies in the wound as a helix, the end of the wire appearing through the skin as the last of the thread is withdrawn. Care should be taken to see that the fascia, which is thus brought together, has been carefully cleaned of fat. This cleaning is best done when making the primary incision and before incising the fascia. By holding the belly of the knife at a suitable angle, the fat is easily separated for one-half inch on each side.

4. A handled needle with an eye at the point is then introduced through the skin and fat about an inch from the other end of the incision, and brought out just above the fascia so as to engage the other end of the wire, which is then withdrawn. This needle has been previously passed through two pads, about an inch square and made of six or eight thicknesses of gauze. Before withdrawing the wire from the needle, one of these gauze pads is slipped down over the wire so as to rest next to the skin. The other end of the wire is then threaded through the needle and the other gauze pad placed in position, and a perforated shot placed outside of each pad.

5. The incision is then carefully dried, if there has been any oozing, and while an assistant draws up the ends of the silkworm gut, so as to secure apposition of the peritoneum throughout, the wire helix is drawn straight by traction with forceps on each end, care being taken to see that no kinks are formed during this process. The wire should be drawn back and forth once or twice so as to be sure there are no kinks.

The perforated shot are now pushed down against the pads and clamped.

6. The fascia is thus held in absolute contact, and the operator can *see* that not a bit of fat or muscular tissue intervenes. The silkworm gut is then tied in the usual way, care being taken that it is not drawn too tight, as this is probably the most common cause of stitch abscesses. The use of the silkworm gut precludes any possibility of dead spaces; all the tissues are brought into absolute contact, layer to layer.

In an abdominal wall enormously thickened from a deposit of fat, this method cannot be used, since the pressure of the silkworm gut would be too great. Here I usually close the peritoneum, including the transverse fascia, with fine catgut; the muscle and fascia in two layers with chromicized catgut No. 1, which will last three or four weeks, and then the skin and fat with through-and-through silkworm gut, so as to secure good, but not tight, apposition. Gloves are always used in closing incisions in this way. In order to drain the dead space between the fascia and fat, a wick is introduced of iodoform gauze, wrapped in gutta-percha tissue, which extends from the upper end of the wound throughout its entire length and is brought out at the lower angle of the incision, this being introduced, of course, before the silkworm-gut stitches are tightened. Any oozing that takes place will be carried off by this wick, which is withdrawn the next morning.

In cases in which the recti muscles are widely separated, no attempt is usually made to bring them together, but extra care is taken to secure apposition of the fascia.

The line of incision is supported by a snug binder of canton flannel, made in the form of a many-tailed bandage. The bandage is so made that each strip overlaps the one below by about one-half its width, and they are stitched together up and down at the back by two lines of stitches several inches apart, so that there is little tendency for the binder to be thrown into folds.

If the case does well, the dressings are not removed from over the wound until the tenth day. (The bandage can, of

course, be removed at any time if it becomes soiled.) The dressings are then removed and all sutures withdrawn. The wire having been drawn straight at its introduction is one of the easiest stitches to withdraw at this time. The gauze pad at one end is caught with the fingers and the wire drawn out a little beyond the skin and cut off. Traction at the other end results in its easy withdrawal. If a stitch abscess occurs, then the affected stitch is at once withdrawn, and, if it seems best, one or two on each side; but the wire is not disturbed until the usual time. The bandage is reapplied, and is worn continuously as long as the patient remains in the hospital,—usually about three weeks. She is then directed to wear a similar bandage day and night for one month, except as it is removed for bathing, and then to wear it during the day for still a second month. At the end of that time, about three months altogether, she is directed to discard it entirely. Experiments upon animals have shown that healing is complete at the end of three months. To wear a bandage longer than this time is therefore unnecessary, while the weakening of muscles, as the result of prolonged support, is undesirable. The use of the bandage is simply to support the parts during the healing process, so that they may not be separated by any sudden strain or effort.

If other surgeons have used this method before the date mentioned, I have no knowledge of such fact. I know of a number of surgeons who are using this method now, having seen it employed in my clinic. I have not undertaken to trace up all the patients upon whom I have used it, but, as I have heard from the usual number of post-operative hernias in which I had closed the incision by other methods, I believe that I would have heard from some hernias resulting from this method if many of them had resulted. Moreover, with few exceptions, the patients operated upon have not been of the class which drifts around from hospital to hospital, as in the large eastern clinics, but have been almost entirely what would be called private patients.